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The Development of Managerial Accounting in Germany

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A Historical Analysis

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During the second half of the 19th century managerial accounting developed in Germany based largely on micro-economic theory. In the first 3 decades of the 20th century the emphasis shifted towards costing techniques and later (in the 1930s' and 40s') towards determination of "true cost", by-and-large for government contracts. The outcome was a highly developed systematic approach which had a major impact on cost accounting in most continental European countries. The major difference to US developments was the separation of cost (viewed as accounting for consumption or utilization of physical resources) from traditional accounting expenses, allowing easier inflation adjustments and concentration on reproduction or replacement costing.

After WWII the emphasis shifted to cost theory, resulting in the adoption of limitational rather than substitutional production functions as the basis of analysis and search for (minimal) cost combinations. Gutenberg examined various adaptation patterns as a response to output changes and demonstrated limits of the break-even-analysis. By creating a more sophisticated theory based on an indirect rather than a direct relationship between output and cost managements' options for influencing cost are highlighted. This provides a theoretical foundation for the utilization of activity costing - which was adopted earlier by German companies than their US competitors. These theories represent little known developments which might stimulate theory research in the US.

Managerial accounting as a major tool of management decision making is closely tied to the development of accounting in general. In analyzing its development it will be necessary to refer to financial accounting occasionally. To show distinctive steps in German managerial accounting development, it will broken down into several periods: these are (1) the time before 1900, (2) the period of early academic analysis until the mid 1930s' (coinciding with the early stages of business administration as an academic subject), (3) the period of government standardization and control until 1945, and (4) the period after WWII leading up to today's decision oriented management accounting.

I. Management Accounting before 1900.

1. Cost Behavior Analysis.

As long as merchants have kept records, they have attempted to relate expenses to specific activities in order to determine how much profit accrued with each transaction. Initially this was regarded as a secret procedure and carefully guarded. Early on it was also realized, that expenses might decline with growing quantities. As Schneider [1] points out, these ideas can already be found in the writings of Antonio Serra (1613), Adam Smith, and others. In the German accounting literature May [2] mentions "disproportionate" overhead (disproportionirte Unkosten) and Leuchs [3] distinguished acquisition related expenses into sales related and independent (presumable fixed) cost. On the other hand, economists concerned with agriculture such as Turgot (1727 - 1781), Thuenen and others pointed out that increasing efforts will not necessarily yield increasing returns, thus laying the foundation for another type of cost behavior (increasing marginal cost). It is, therefore, save to assume that the distinction between different groups of cost has been used much earlier than most 19th century authors claim.

2. Internal and External Accounting; Price Determination.

The distinction between financial and factory accounting records can also be traced in the literature to the end of the 14th century [4]; however, this differentiation is more frequently mentioned as the result of industrialization in the late 18th century (Klipstein [5], Jung [6], and Fredersdorff [7]). At this time, the terms "Fabrickbuchhaltung" (factory accounting) and "Handlungsbuchhaltung" (financial accounting) are introduced. The factory accounting tasks consisted in determining how much had been spent on a product and for how much it had to be sold to reap appropriate benefits. Practical desriptive examples, however, were rare because the attitude of secrecy mentioned earlier still prevailed. The first comprehensive description of a price determination system (Kalkulation) is attributed to Ballewski [8] who also deals with the issues of cost behavior at different output levels. This was soon followed by arguments (Tolkmitt [9]) pointing towards the central role of costing for all future oriented decisions as the basis for management. Dorn [10] classifies all these attempts as a preliminary stage of cost accounting; most publications of this period contain substantial details, give technical advice how to handle certain procedures, but neither systematize the material nor attempt to critically evaluate procedures found in various businesses.

II. 1900 - 1930s.

1. General Trend.

Increasing industrialization jointly with the recognition of business as an academic subject (foundation of business schools in Leipzig and Cologne in 1898) focused interest on the issue of cost determination. The first major systematic analysis was published by Leitner [11] in 1905. A complete description of the system used by a well known company followed in 1907 [12]. The Association of German Equipment Manufacturers (VDMA)

surveyed the procedures used in this industry and published the results in 1908 [13]. All these treatments of cost accounting issues concentrated on procedural and technical aspects. In addition, the causation principle, recommended bases for allocation of overhead among departments, and the redistribution of all cost items to products were discussed. It is interesting to note, that already at this time the viability of labor cost as an allocation basis was called into question.

During this time period internal and external accounting were still viewed as a continuous flow throughout the company and treated as an unified system. Much of the material published is not very different from cost accounting procedures still discussed in modern text books.

2. Separation of Expenses and Cost.

During this time period the development was strongly influenced by the contributions of Schmalenbach, then a dominant figure in academia, who made several suggestions which later had a major impact on practical accounting. His major conceptual contribution was the demand to clearly distinguish between (1) cash expenditures, (2) expenses, and (3) cost. He observed, that not only is there the well known distinction between cash flows and expenses (requiring period allocation of expenses according to the matching concept), but that cost represent a summary of resource input quantities (rather than money) into the production or service generating process. This being so, traditional accounting - particularly under inflationary circumstances - is unable to truly represent a basis for pricing of products. If, however, consumption of goods are represented in the internal accounting process, values (prices) for cost may be introduced at an appropriate date (e.g. at the time of sale). Thus acquisition based financial accounting expenses and cost will differ. The relationship of his three categories is shown in exhibit 1.

(insert exhibit 1 here)

He classifies the major discrepancies between expenses and cost as caused by (1) temporal differences and (2) material differences. Temporal differences are caused by different usage assumptions underlying depreciation (frequently linear in financial accounting, but should be usage based in costing to reflect true consumption and may thus be chargeable to other time periods); both will eventually result in the same total, if they are based on acquisition cost). Other temporal differences can be caused by delayed repairs and overhauls; if not recorded in the period in which they were caused, then cost may be understated for a time and overstated when these items lead to chargeable expenses (resulting in cost fluctuation in spite of the fact that resource consumption remained the same). Obviously, such ideas will raise objections from US accountants, because there is a possibility for income smoothing. Nevertheless, if assessed strictly in terms of real resources consumed for manufacturing and regarded as a necessary part to determine prices, such items should be recorded in matching terms, that is, in periods in which they where caused.

Even more important are material differences, which may fall into two subgroups (a) expenses which will never become cost or vice versa, and (b) cost which are different from expenses due to different accounting (valuation) bases. These material differences shall be illustrated by some examples. There are business activities not connected with manufacturing, such as speculation, financing and other non-minor activities, which are not part of the companies usual business activities. Although nobody would dispute their nature as business expenses, such items do not represent purpose-oriented consumption of resources - therefore they should never become cost of a specific product; such items are expenses in Schmalenbachs' terminology and should be recovered from profits. These items are Schmalenbach's "(cost) neutral expenses". Conversely, there is the

possibility of resource inputs (= consumption) - such as the use of equity capital - not reflected in financial accounting expenses. He recommends, that such items should be recorded as "imputed cost" and added to total cost in order to truly reflect resources used. Other examples are self insurance "premiums" and management efforts by the owner(s) in private enterprises for which no salaries are paid; such items are cost, although not normally recorded as expenses. Schmalenbach insists on the need to adjust expenses before these will represent actual input consumption reflecting cost [14].

3. Uniform systems of Accounts.

It is again Schmalenbach, who contributed to the development of managerial accounting in his efforts to develop uniform systems of accounts [15]. He views managerial accounting as representing internal transfers and transformations which are imbedded into the external transactions of an enterprise; consequently, these should be shown as an integral part of the accounting system. Based on this concept, he recommends a chart of accounts which at the same time provides for internal control and external reporting data. Such a system has to integrate fully any adjustments needed to properly measured expenses and cost as defined above. This view has prevailed in the following period and became part of government imposed accounting requirements (details discussed below).

4. Other Issues.

During this same period several other issues emerged, such as attempts to improve the accuracy of the costing system by standardizing terminology, improving the definition of cost centers and breaking these down into their smallest units (Platzkostenrechnung = accounting for work stations - a concept particularly useful for activity costing). Even early developments of standard costing (Plankostenrechnung) can be traced to this period. At the time it emerged as "normal" or "optimal" costing, referring to the level of capacity usage for which cost where measured.

At the same time prevailing strong inflationary developments triggered detailed suggestions for "up-to-date valuation" of cost (easily accomplished, since original data are simply regarded as quantity measurements, to which a new price assuring the maintenance of the physical substance can be attached). It is specifically the work of Schmidt [16], which brings out these aspects (eventually resulting in the Dutch use of reproduction values initiated by his student Limperg). Schmalenbachs imputed cost procedures facilitates the integration of such items into the regular accounting system. It is noteworthy, though, that Schmalenbach himself never agreed to the use of reproduction cost in his own system - he rather settled for indexing, because he regarded inflationary developments as an abnormal rather than a normal development.

III. 1933 - 1945.

1. Accounting and Pricing Regulations.

This period with its disastrous political developments had a strong effect on accounting, because, rather than nationalization, the German government choose indirect control of industry as its course towards a government controlled economy. This resulted in a codification of prior ideas to develop measurement procedures and thus assure comparable data for controlling all parts of the economy. The major regulatory measures (passed as decrees) were the following:

(1) Wirtschaftlichkeitserlass vom 12.11.1936

(2) Buchfuehrungsrichtlinien (accounting guidelines) of 11/11/1937 [17]

(3) Leitsaetze fuer die Preisermittlung aufgrund der Selbstkosten bei oeffentlichen Auftraegen {LSÖ}(pricing guidelines for all public contracts) of 15.11.1938

(4) Kostenrechnungsgrundsaetze {KRG} (cost accounting guidelines) of 16.1.1939 [18]

The Decree of 11/11/1937 prescribed the organization of accounting systems, made the adoption of Uniform Charts of Accounts - shown in exhibit 2 - mandatory, and specified a fourfold

(insert exhibit 2 here)

purpose, which had to be met by every accounting system, namely to provide

(1) accounting and financial statements (accounting for period results),

(2) cost accounting (accounting for pricing and per unit cost measurement),

(3) business statistics (for internal and external comparison), and

(4) planning (projection for future periods).

Particularly requirement #2 brought major changes to the German accounting practice by introducing imputed cost items and tying financial and managerial accounting together into one system.

2. The integrated financial/cost accounting process.

The new system was designed to accomplish measurement purposes at the individual business and the overall economic level at the same time. It, therefore, adopted a strict input resource consumption definition for costing as proposed by Schmalenbach. For example, interest expenses paid to third parties were not any longer regarded as sufficient to measure cost. Instead capital utilization for a certain process - regardless of source - became the accepted resource definition, because it permits to assess efficient input factor utilization in a single firm as well as in an overall economic context. These requirements were regarded as minimal necessary comparative information, to provide "true" performance based guidance for entrepreneurial and governmental decisions. In order to standardize all measures which might cause differen-

ces between expenses and cost similar to the already discussed issue resulting from different financing procedures (borrowed versus equity capital) four mandatory groups of imputed cost were introduced. In addition to financing, legal organization (corporation v. sole proprietorship), asset utilization patterns (systematic balance sheet value based depreciation v. machine usage based consumption), and specific - often uninsurable risks - were subjected to this treatment, resulting in the use of

(1) imputed management salaries,

(2) imputed interest,

(3) imputed depreciation, and

(4) imputed risk charges [19].

On the procedural level, all actual expenses potentially requiring adjustments were debited to "neutral" expense accounts in class 2; imputed cost are debited to cost accounts in class 4 and credited to corresponding accounts in class 2. Since the accounts of classes 4 and 2 - after some intermediate steps - are closed out to the income statement, all original and adjusted entries remain traceable, neutralizing each other before financial accounting profits are calculated. At the same time, operational results can be calculated by routing manufacturing cost including imputed cost through a special "Betriebsergebnis" (operations) account. This procedure is shown in exhibit 3 [20].

(insert exhibit 3 here)

Regarding depreciation, the principle of a single write down to zero was maintained for financial accounting, using acceptable (largely tax based) guideline lives for assets, whereas for costing purposes other procedures (such as output related depreciation or a valuation basis different from financial records) were admissible (it is noteworthy, that in such a system differences arising from inflationary developments affecting specific or all cost items as well as delayed repairs and similar events can be

accommodated, even if this was not foreseen at that time). Over- or underestimation of actual life spans were treated as a special depreciation risk.

The system attempted to measure "normal" manufacturing cost, and to separate cost items occurring only in connection with specific orders (Sondereinzelkosten und Sonderkosten) [21]. Normal cost were defined in relationship to capacity utilization and corresponded to what is referred to in the US as practical capacity. However, at that time the system was geared towards actual rather than standard costing. It also prescribed specific steps for overhead cost allocation and distribution (at normal capacity).

In determining the admissable capital usage charge the notion of "required capital" (betriebsnotwendiges Kapital) was developed, which assumed the possibility of assessing capital needs for certain types of production (established by comparison on an industry-wide basis). This notion even today may offer some interesting opportunities for comparing actual capitalization with a "most efficient" input, although it is admittedly difficult to determine optimal levels.

In addition to accounting standardization, the system provided pricing guidelines for all government orders (LSÖ - Leitsaetze fuer die Preisbildung bei oeffentlichen Auftraegen). For this purposes a general scheme was adopted - see exhibit 4 -.

(insert exhibit 4 here)

In order to keep records at a comparable level reflecting all typical cost, special cost items (Sondereinzelkosten) are not routed through regular accounts but treated as items chargeable directly to the special orders or products. The system also required the separation of materials overhead from general production overhead.

The application of all requirements incorporated in the decrees resulted in a systematic partitioning of the managerial accounting into it's 3 major parts, namely

(1) cost accumulation (Kostenartenrechnung), for purposes of cost classification and adjustments,

(2) Cost distribution to consuming departments according to the causation principle or established distribution ratios (Kostenstellenrechnung), which can be seen as the major departmental control procedure, and

(3) cost allocation to products, jobs, or output batches (Kostentraegerrechnung) for purposes of pricing.

This approach - shown in exhibit 5 - is still maintained in all

(insert exhibit 5 here)

textbooks and costing regulations. It can also be found in practically all other European and in the East Bloc countries (with the modifications required by political doctrine).

After the end of the war all prior government accounting regulations by decree were invalidated. However, the Association of German Manufacturers (Bundesverband der Deutschen Industrie) reissued its own private recommendations in 1949/51 [22], which essentially retained the same costing rules and procedures; new government pricing regulations within a similar framework replaced the use of acquisition cost with market prices.

It should be noted, that during the period until 1945 a strict resource consumption definition of cost was adhered to and cost were regarded only as the monetary expression of quantities. The so-called "pagatoric cost view", that is a payment based cost definitions, which does not classify as cost any inputs, which have been acquired for free or are priced different from the actual payments (such as inflation adjustments) only emerged after WWII [23]. The 'pagatoric" view objects to the hypothesis, that "resources are acquired at the day of consumption" rather than at the real acquisition date and, therefore, defines cost similar to financial accounting expenses.

IV. After 1945.

With the re-introduction of a market economy two distinct trends developed in managerial accounting. First of all, it became necessary to change the research emphasis from measuring 'true cost'—simply for purposes of a cost-plus pricing—towards the development of cost-based decision tools. During the following 40 years the emphasis of this decision-making tool was gradually adjusted from short-term to long term strategic decision-making. Secondly, the teaching of business administration concepts in Germany shifted from a mere interpretation of government rules towards a science of 'optimal' behavior of business entities in free market. As a consequence, managerial accounting turned towards the empirical and theoretical study of cost behavior and the analysis of specific cost items to guide firms towards profit maximization. However, the German development concentrated much more on theory rather than practical procedures.

1. Managerial Accounting - basis for decision making

First of all, the traditional absorption costing approach was replaced with a direct costing view. As it turns out, that did not constitute a real innovation, because Schmalenbach [24] had already suggested the use of direct cost in 1899. These 'marginal cost concepts' were strongly reinforced by adoption of direct costing ideas from the US, however, carried to a higher level of sophistication by introducing multiple levels of cost influencing factors (rather than assuming that variable cost were exclusively output dependent) by Riebel [25]. He developed the distinction between direct and indirect cost farther by introducing the idea of a hierarchy of allocation bases, for which contribution margins should be measured. He goes beyond the definition of direct product cost and treating the entire remaining items as indirect cost. Instead, he defines direct cost with respect to output, lot size, time consumption etc. and observes, that depending on the

allocation basis used, some cost items may be treated as either direct or indirect. This enables management to define and utilize more than one 'contribution' margin level to analyze its decisions, thus gaining deeper insights into the behavior of all indirect cost.

Another often overlooked development of this period is the work of Schnutenhaus [26]; he suggests that certain types of fixed cost are not allocable, because these are related to future products and activities ("survival cost" such as R&D and similar items). He recommends as basis for their allocation short-term (specific activity) or long-term (present volume or profit) survival needs (present most profitable product must contribute most). This method is currently practiced by many high-tech manufacturers. Earlier recognition of this approach would have made decades of futile discussions about overhead allocation unnecessary.

Another trend can be found in the incorporation of standard costing. Initially, it was adopted as it existed in the US. Subsequently this system was changed into what is known today as "double" or "multiple" flexible standard costing. Instead of relating cost to volume as the only independent variable, systems emerged, which incorporated additional independent variables such as lot size, production program, processing techniques, routing, input factor quality, processing speed, and other technological criteria. This produces a substantial number of new variances, which require analysis of their significance before being included into practical systems [27].

Since the end of the 70s' it was recognized, that a short-term orientation might create misinformation for strategic purposes, especially as far as pricing is concerned. New capital-intensive process technologies rendered traditional managerial accounting systems inadequate and required new approaches. Growing indirect cost had to be remeasured and allocated to various activities encompassing more then one cost center. This approach permits not only a separate efficiency measurement for activities but also

the identification of typical 'activity cost' for allocation of cost to products [28]. This procedures eventually lead to the identification of cost drivers - as presently discussed in the US literature. The process/activity costing approach has been applied by many German firms since the 1970s. This was facilitated by the relative direct costing approach propagated by Riebel (mentioned above), and the development of more sophisticated multiple flexible standards. A substantial part of these changes can be attributed to Gutenbergs' extensive production and cost theory analysis which will be discussed below.

With the rediscovery of market prices in a free market economy the question arose whether such market mechanism could also applied for global optimization purposes in firms with decentralized decision making. Again, it was the pioneering work of Schmalenbach on transfer pricing which led to the adoption of procedures utilizing alternatively market prices, variable cost and shadow prices.

2. Cost (behavior) Theory.

On a more conceptual level - referred to as cost theory in the German literature - several major post war developments should be noted [29]. Traditionally, scholars recognized the "law of diminishing returns" (Ertragsgesetz) as a basis for cost hypotheses, resulting in the assumption of an S-shaped cost curve (as used in micro economics). The accounting literature frequently replaced this notion with the simplifying assumption of straight line break-even point analysis. In 1950 Gutenberg [30] substantially extended this approach. He coined the term production function of type A for traditional S-shaped approaches and made an attempt to explain cost behavior (based on earlier observation by J. Dean, which were not pursued further in the US) on a more sophisticated level. He called his approach production function of type B.

Gutenberg dispenses with the assumption of peripheral substitution of production factors and replaces it with the assumption of 'limitational' production conditions. A direct cost-output relationship does not exist under these circumstances. Therefore, no singular production or cost function can be defined. The analysis of cost behavior is possible only by analyzing the consumption of production (that is input) factors, which in turn are governed by the technology (equipment or processes) employed. To summarize his approach in non-mathematical terms it can be said that Gutenberg analyses a multi-stage production function from which appropriate cost functions may be derived. According to this, the output of a single 'aggregate' (e.g. machine or selfcontained production unit) basically depends on three variables:

(a) the economic consumption function for all input factors related (that is influenced) by this aggregate;

(b) the economic performance within a time period (by-and- large operating speed, called 'intensity');

(c) the utilization time of the aggregate.

These relationships are the starting point of his hypothesis. The basic idea is, that cost do not vary automatically with output levels, but are influenced rather by managements decisions responding to different demands for output. It is evident, that the following options are available for such a response: (1) adaptation of operating time, (2) adaptation of operating intensity, and (3) adaptation of the quantity of input factors.

(1) If the quality and quantity of input factors (so-called potential factors) is assumed to be fixed for the observation period, then the company is able to respond by adjusting usage time (overtime, reduced shifts etc.) or by changing intensity of usage (faster or slower machine runs). This will lead to progressive cost, if normal capacity is

exhausted. Cost behavior resulting from these types of adaptations is shown in exhibit 6.

(insert exhibit 6 a and b)

(2) A quantitative adaptation occurs, when the quantity of aggregates (machines, employees) is adjusted. This may be done either on a short-term or a long-term basis. Total cost will increase/decrease following these actions; resulting per unit cost in case of capacity increases will depend on whether new aggregates will be fully used or remain partially idle. In case of capacity decreases cost will depend on whether aggregates will remain or will be sold. These cost are shown in exhibit 7.

(insert exhibit 7 here)

(3) Other forms of adaptation result whenever there is change in the qualitative combination of input factors. Since lower quality of input factors results in higher cost, the resulting cost curve tends to be progressive in many case of output increase (lower qualifications or quality). In case of decreases it should reduce quickly, whenever there is a possibility to reduce utilization of low quality input factors. This so-called selective adaptation is shown in exhibit 8.

(insert exhibit 8 here)

If there is a permanent increase of capacity, usually new technologies and improved (or different) qualities of input factors will be employed. This will result in a so-called mutative adaptation, which establishes an entirely new cost level; these potential developments are shown in exhibit 9.

(insert exhibit 9 here)

Gutenberg's theory obviously approximates reality more closely than earlier hypotheses, because it explains the fact that a given output does not necessarily result in a single cost function, but can be accomplished by several different input combinations.

However, it also suggests that it may not always be possible to make an accurate prediction of cost levels, because of remaining practical measurement problems.

Gutenbergs approach was utilized by practically all German scholars in the following decades, resulting in further sophistication by Heinen [31] and others, who extended his analysis. Heinen - in defining his production function of type C - wants to measure so-called "elementary input factor combinations" which describe basic segments of the production process. Once their cost and all cost determining factors (which today might be called cost drivers) are known, the cost function for a specific combination of processing steps can be determined.

In summary, it can be said that German cost theory based on production functions went beyond the prevailing rather unsophisticated direct cost-volume relationship. It replaces the traditional approach with a more detailed cost behavior analysis which relates cost closely to input rather than output; it also explains the impact of management's actions as well as the fact that the same output can be obtained with various cost levels. In this respect, it can be classified as a comprehensive theory (or at least hypothesis) which provides for situation-adequate cost projections.

It appears justified to conclude that today's attempts to control cost, to provide elaborate data bases, and to isolate and monitor cost drivers will not reach their objective, if there is a lack of conceptual underpinnings. For this purpose the German theoretical studies provide a step forward, if compared with the simplified analytical approaches found elsewhere in the cost literature. Utilizing some of these ideas combined with modern statistical methods might contribute to further advancements, because it will permit the development of practical approaches for activity costing in high

technology environments based on a more comprehensive theoretical framework. Of course, whether this theory is complete and sufficiently tested remains an open question.

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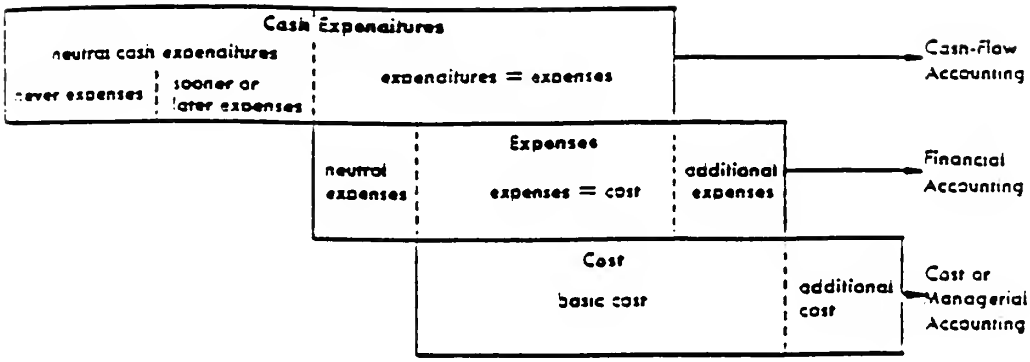


xhibit 1: Relationship between expenditures, expenses and co

Exhibit 2: Uniform Chart of Accounts (Gemeinschftskontenrahmen)

1951 version

Class 0

Fixed Assets and Long-term Capital

Class 1

Current Assets and Current Liabilities

Class 2

Neutral Expenses and Income

20 *Nonoperating expenses and income.*
- 200/5 Extraordinary nonoperating expense and income.
- 206/9 Recurring nonoperating expense and income.

21 *Expense and income of land and buildings.*
- 210/9 Analysis.

22 Free.

23 *Depreciation.*

24 *Interest expense and income.*
- 240/1 Interest paid.
- 242/4 Discounts given.
- 245/6 Interest received.
- 247/8 Discounts taken.

25/26 *Extraordinary operating expense and income.*

25 *Applicable to the period.*
- 250/1 Sundry losses.
- 252/ Other expense and income accounts.

26 *Applicable to other periods.*
- 260 Fixed assets.
- 261/5 Maintenance.
- 266 Research.
- 267 Taxes.
- 268 Other expenses.
- 269 Income.

27/28 *Contra-account.*

27 *Expenses applicable to other periods included in cost accounts.*

28 *Other calculations for cost accounts (contra-account).*
- 280 Excess depreciation.
- 281 Interest charged.
- 282 Contingency reserves.
- 283 Notional salary for proprietor.
- 284 Other calculations.

29 *Expenses and income relating to operations as a whole (e. g., corporation taxes).*

Class 3

Materials

30/37 *Materials.*
- 300/79 Analysis.

38 *Parts purchased and work given out.*

39 *Manufactured goods purchased.*
- 390/6 Purchases.
- 397 Adjustments to inventories.

Class 4

Cost by Type

40/42 *Materials.*

40/1 *Materials consumed.*
- 400 Control account-materials consumed.
- 401/19 Analysis (direct, indirect; raw, finished, etc.)

42 *Fuel and power.*
- 420 Fuel.
- 429 Power.

43 *Salaries and wages.*
- 431/8 Analysis.

44 *Social security cost.*
- 440/7 Health, unemployment insurance, etc.
- 447 Voluntary contributions.
- 448 Other welfare costs.

45 *Maintenance.*
- 450 Land and buildings.
- 451 Plant and machinery.
- 452 Vehicles, tools.
- 453 Equalization account.
- 454 Other.
- 455 Services.
- 456 Laboratory and research.

46 *Taxes, licenses, insurance premiums, etc.*
- 460/3 Taxes on income and capital.
- 464/7 Other taxes and licenses.
- 468/9 Insurance premiums, etc.

47 *Rent and administrative cost.*
- 470/1 Rent and machine hire.
- 472/3 Travel, transportation, and carriage.
- 474/5 Postage, telephone.
- 476 Office cost.
- 477/8 Publicity and representation.
- 479 Financial expenses.

48 *Imputed cost.*
- 480 Imputed depreciation.
- 481 Imputed interest.
- 482 Imputed risk charges.
- 483 Imputed owner's salary.
- 484 Others.

49 *Internal transactions.*

Class 5—Class 6

Cost Accounts

Reserved for departments, other cost centers, products, processes, etc.

Class 7

Inventories of Finished Products.

70/77 *Reserved for costs not allocated to cost centers, products, etc. (selling costs, etc.).*

78 *Inventory of work in progress.*

79 *Inventory of finished goods.*
- 799 Adjustments to book values of inventories.

Class 8

Income

80/82 *Reserved for selling cost accounts.*

83/84 *Income from products and services.*

85 *Income from resale of goods purchased.*

86 *Income from by-products and secondary activities.*

87 *Income from services performed by the business for itself.*

88 *Income adjustment accounts.*
- 880/2 Additions to income.
- 883/9 Reductions of income.

Class 9

Closing Accounts

90/96 *Reserved for summarization and special needs.*

97 *Cost, operating statements.*

98 *Profit and loss accounts.*
- 980 Manufacturing accounts
- 981/4 Free.
- 985/6 Inventory adjustments.
- 987 Net result of neutral expenses and income.
- 988 Expenses and income affecting operations as a whole.
- 989 Profit and loss accounts.

99 *Balance Sheets.*
- 998 Opening balance sheet.
- 999 Closing balance sheet.

Let us assume that depreciation for financial accounting purposes is $100 for a given period; usage-based imputed depreciation costs amount to $80. First, both items are recorded as follows (account numbers correspond to exhibit 3):

	Debit	*Credit*
1. Depreciation expenses (account 260)	$100	
Depreciation reserve (account 029)		$100
to record straight-line depreciation for period		
2. Imputed depreciation (account 480)	$ 80	
Contra-account for imputed depreciation (account 280)		$ 80
to record imputed depreciation.		

At the end of the period, depreciation costs (from account 480) will be transferred — via several manufacturing steps not shown here for brevity — to the finished goods account. Assuming the entire quantity produced during this period is sold, these costs will be transferred into the cost-of-goods-sold account and eventually to profit and loss, as shown in the following.

	Debit	*Credit*
3. Finished goods (account 79)	$ 80	
Imputed depreciation (account 480)		$ 80
to transfer depreciation cost		
4. Profit and loss (account 989)	$ 80	
Finished goods (account 79)		$ 80
to transfer depreciation included in products sold.		

At this point, the profit and loss account contains only imputed depreciation, thus showing amounts differing from actual depreciation. To correct this, three more entries are necessary:

	Debit	*Credit*
5. Summary of class 2 accounts (account 987)	$100	
Depreciation expenses (account 260)		$100
to transfer actual depreciation for closing		
6. Contra-account for imputed depreciation (account 280)	$ 80	
Summary of class 2 accounts (account 987)		$ 80
to transfer imputed depreciation for closing		
7. Profit and loss (account 989)	$ 20	
Summary of class 2 accounts (account 987)		$20
to transfer difference between actual and imputed depreciation.		

These seven entries assure that the profit and loss account contains the appropriate expense amount for each period. All inventories of semifinished and finished products contain depreciation on the basis of imputed cost exclusively.

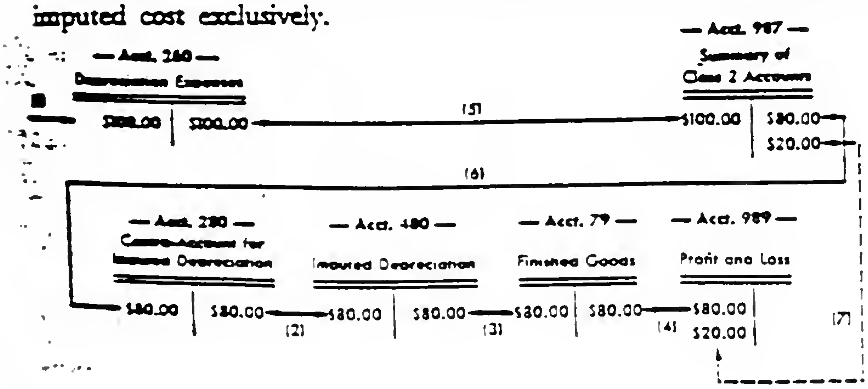


Exhibit 3: Accounting procedure to introduce and eliminate imputed cost

Materials (*Stoffkosten*)
Direct Material
\+ Material Overhead
\+ Processing Cost (*Fertigungskosten*)
Direct Wages
\+ Overhead (percentage of wages, preferably separate for all participating production departments)
\+ Specific Processing Cost (only if costs exist which are related to individual products or orders)

\+ Research and Development Cost (*Forschungs- und Entwicklungskosten*)

= Total Manufacturing Cost (*Herstellkosten*)

\+ Administrative Cost (*Verwaltungskosten*)
\+ Marketing Cost (*Vertriebskosten*)
\+ Special Marketing Costs (such as taxes and commissions)

= Total Cost to Company (*Selbstkosten*)

Exhibit 4: Cost accumulation steps for pricing

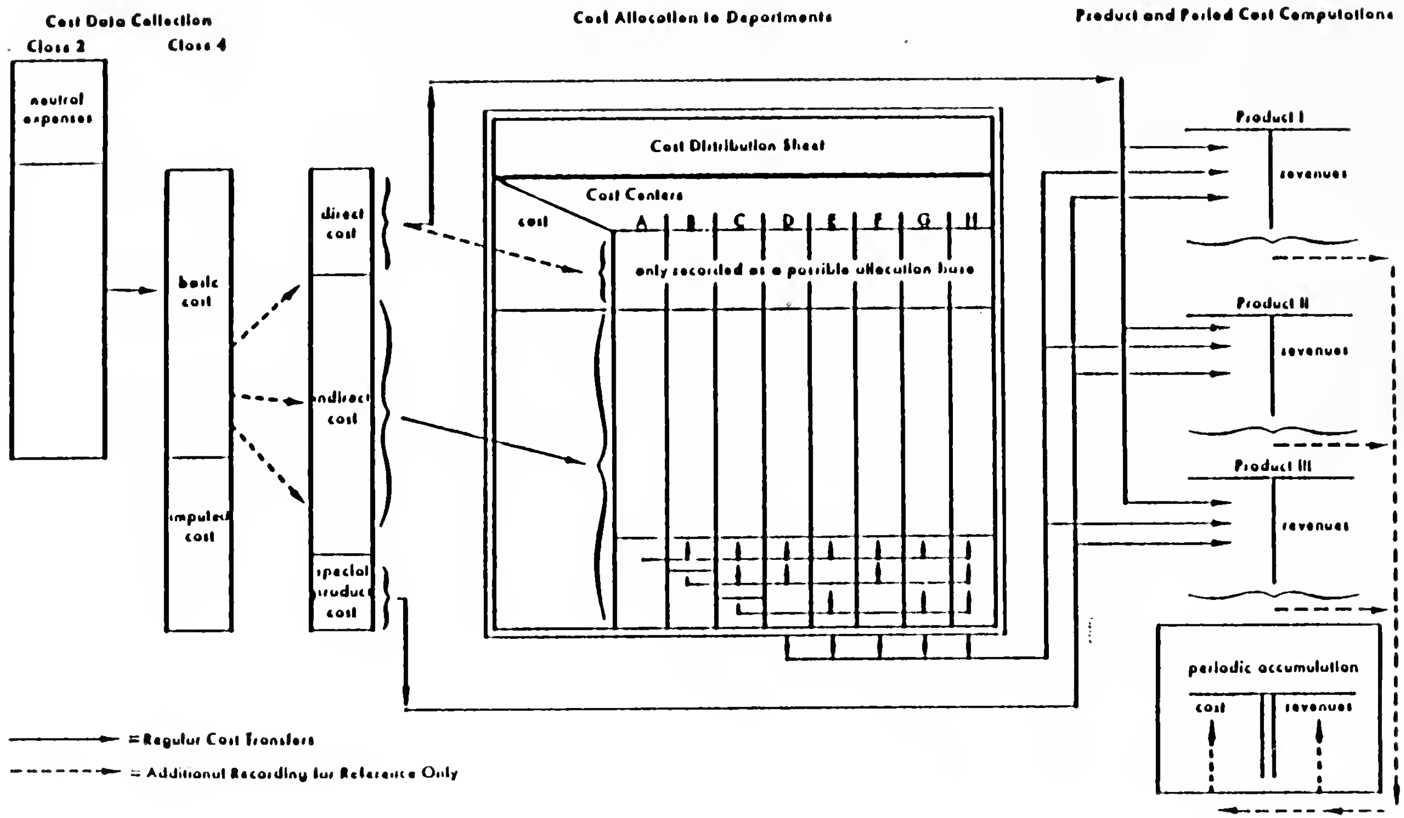
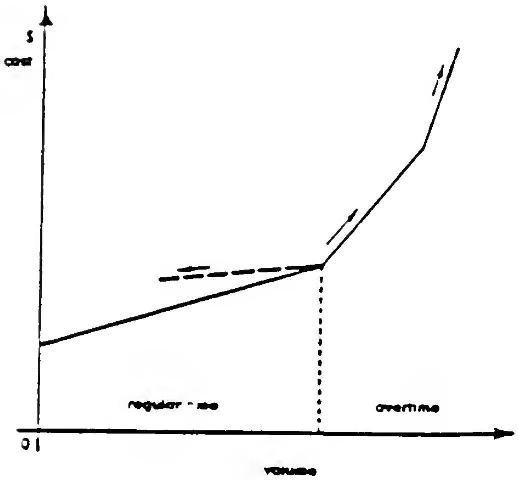


Exhibit 5: Systematic representation of costing system.

COST RESULTS OF ADJUSTMENT OF OPERATING TIME



APPROXIMATION OF COST CURVE AFTER INTENSITY ADAPTATION

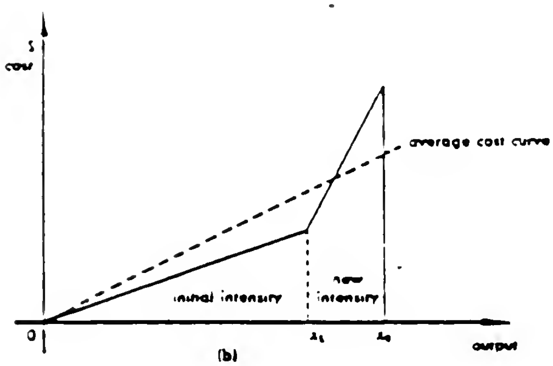


Exhibit 6: Cost behavior resulting from adaptations to different outputs levels (Gutenberg's theory).

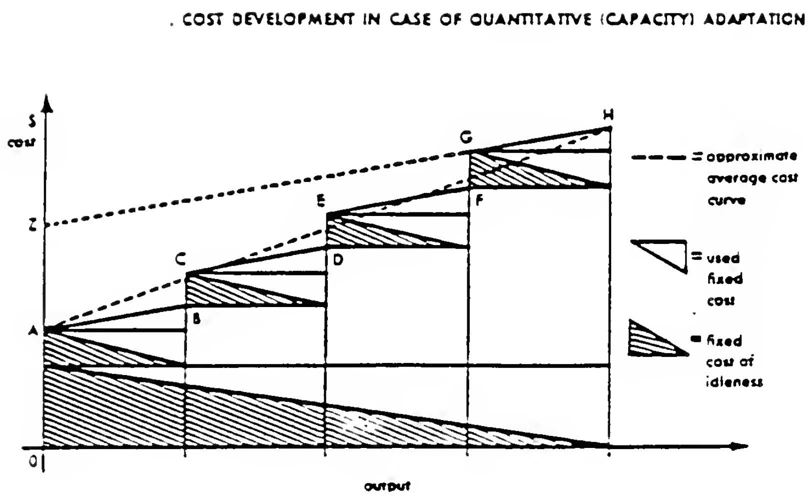


Exhibit 7: Quantitative adaptation (adding new capacity).

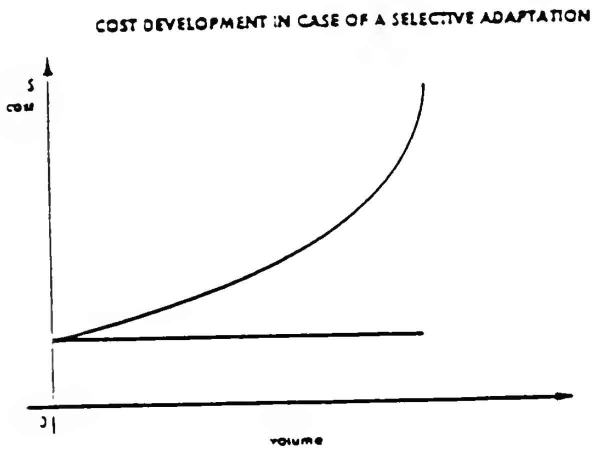
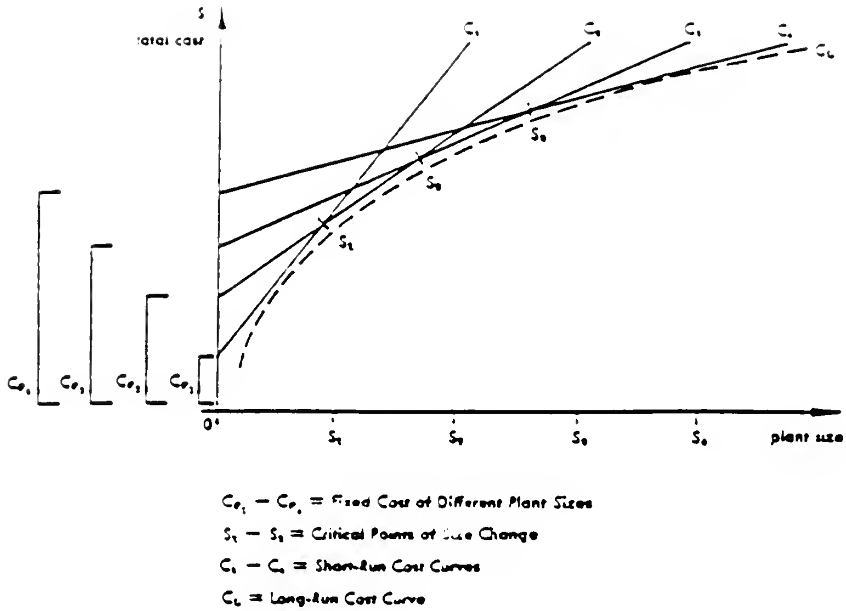


Exhibit 8: Selective (qualitative) adaptation.



<u>Exhibit 9</u>: Mutative cost changes over time.